

FORMALITIES

The Applicants bring to the Examiner's attention that a Supplemental Information Disclosure Statement including five (5) references was filed on October 24, 2003. The Applicants respectfully request that the Examiner consider the references before issuing another Office Action for this application and provide the Applicants with a copy of Form PTO-1449 that has been duly initialed as having been considered.

REMARKS

Claims 1-13 are pending in the subject application. Claims 1-3 stand rejected under 35 USC 103(a). Claims 1-3 have been canceled without prejudice. Claims 4-13 have been newly added.

The Applicants appreciate the Examiner's thorough examination of the subject application. However, the Applicants respectfully request reconsideration of the subject application based on the following remarks.

35 U.S.C. § 103(a) REJECTIONS

The Examiner has rejected claims 1-3 under 35 USC 103(a) as being unpatentable over U.S. Patent Number 6,597,520 to Wallerstein, et al. ("Wallerstein" or the "Wallerstein Reference"). Claims 1-3 have been canceled without prejudice. Therefore, the grounds for rejection are moot. However, with respect to the newly added claims, the reasons for patentability over the Wallerstein reference are provided below.

The invention as claimed provides an omnidirectional vision sensor that substantially reduces blind spots in a portion of the field of view. More specifically, the present invention reduces blind spots in the frontal direction. To that object, the present invention includes a body-of-revolution mirror 60 with a cutaway section 62.

[T]he frontal direction of the camera 61 (the upper direction of the optical system) can be seen through the cutaway section 62 provided in a central portion of the convex portion of the body-of-revolution mirror 60, which is disposed so that the convex portion faces the camera 61.

Specification, page 16, lines 7-13 (Emphasis added).

As shown in FIGs. 1 and 2 of the present invention, this arrangement provides a field of view in the frontal direction of the camera 61 with blind spots confined to peripheral areas.

Claim 4 of the present invention recites an omnidirectional vision sensor comprising an optical system including a body-of-revolution mirror that includes a cutaway section, imaging means including a light-receiving element, and image processing means, wherein the revolution axis of the body-of-revolution axis and the optic axis of the light-receiving element coincide. With this structure, the invention as claimed can provide an omnidirectional vision sensor wherein the field of view can be expanded above the optical system where there is typically a blind spot in conventional structures, See, e.g., Specification, page 16, lines 13-16. The expanded field of view is achieved by the provision of a cutaway section in the convex portion of the body-of-revolution mirror, which allows the frontal direction of the camera, i.e., the light-receiving element, to be seen through the cutaway section. See, e.g., Id., page 16, lines 7-13.

Figure 3 of the specification shows the images obtained by the claimed omnidirectional vision sensor. An image appearing in the outer region 80 is an image of a horizontal span covering 360 degrees around the body-of-revolution mirror. An image appearing in the inner region 81 is an image of an area lying in the frontal direction of the camera, which is obtained through the cutaway section of the body-of-revolution mirror. See, e.g., Id., page 18, lines 13-19.

Wallerstein

The Wallerstein reference, however, discloses a panoramic imaging arrangement that includes a lens block 14, a mirror 16, and a system of lenses 18. The lens block 14 includes a transparent component 20 having a first, upper, convex surface 22 and a second, lower, concave surface 24 that are both symmetric about the axis of revolution 12. The lower, concave surface 24 has a reflective material formed thereon. A hole 28 is formed vertically through transparent component 20. See, e.g., Wallerstein, col. 2, line 65 to col. 3, line 7; Figure 1.

Incident light on the upper concave surface 22 enters the transparent component 20; is reflected upward by the reflective surface 38 of the lower concave surface 24; exits the transparent component 20; and is refracted downward by a mirror 16; before being refracted by a series of lenses 50, 52, and 54. See, e.g., Id., col. 3, line 62 to col. 4, line 25. However, there is no cutaway section in the central portion of the mirror shown in the figures or described in the specification, that allows light and images from the frontal direction to pass through the mirror to the camera.

Moreover, according to the Wallerstein reference, the panoramic imaging arrangement has a field of view "of approximately 80° (from 20° below the horizon line to 60° above the horizon line)." Id., col. 6, lines 7-10 and lines 39-42. This means that Wallerstein leaves a blind spot in the frontal direction of approximately 60°, i.e., 30° to either side of vertical. Thus, a panoramic imaging arrangement is provided that is capable of capturing a view of a 360° surrounding panoramic scene. See, e.g., Id., col. 4, lines 26-28. However, the panoramic imaging arrangement of Wallerstein does not provide a field of view in a direction vertically above the optical system and, as a result, has a substantial blind spot in the frontal direction. See, e.g., Id., col. 3, line 64 to col. 4, line 1; Figure 1. This teaches away from the invention as claimed.

Accordingly, the Wallerstein reference does not teach, mention or suggest the claimed omnidirectional vision sensor that is capable of capturing a field of view vertically above the optical system, which is to say, an image of an area lying in the frontal direction of the optical system.

Japanese patent application publication No. 2000-322564

The prior art of Japanese patent application publication No. 2000-322564 discloses an omnidirectional visual sensor wherein a wide angle lens is positioned at the outside opposite to the convex portion of a body-of-revolution mirror, as shown in Fig. 1 and Fig. 4, but not within a round hole 3a of a curved-shaped reflector 3 so that the wide angle lens is not provided within a cutaway section of the body-of-revolution mirror as taught in the present invention. As a result, the omnidirectional visual sensor of the prior art cannot act to greatly reduce a blind spot in front of an imaging means.

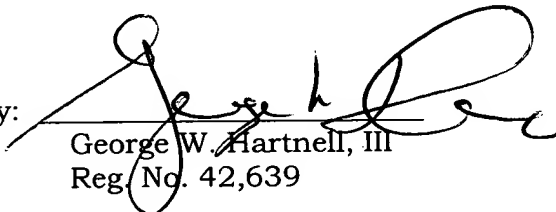
Therefore, it is respectfully submitted that, claims 4-13 are not made obvious by the Wallerstein reference and/or Japanese patent application publication No. 2000-322564, and further, satisfy all of the requirements of 35 U.S.C. 100, et seq., especially § 103(a). Accordingly, claims 4-13 are allowable. Moreover, it is respectfully submitted that the subject application is in condition for allowance. Early and favorable action is requested.

The Applicants believe that no additional fee is required for consideration of the within Response. However, if for any reason the fee paid is inadequate or credit is owed for any excess fee paid, you are hereby authorized and requested to charge Deposit Account No. **04-1105**.

Respectfully submitted,

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